Small Business Innovation Research/Small Business Tech Transfer

In-Situ Monitoring of In-Space Manufacturing by Multi-Parameter Imaging, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

Ensuring production quality is crucial for in-space manufacturing (ISM). The proposed small business innovative research is a feasibility study of an in-situ inspection unit that can be added to an existing additive manufacturing (AM) tool, such as an FDM (fused deposition modeling) machine, providing real-time information about the part quality, and detecting flaws as they occur. The information provided by this unit is used to a) qualify the part as it is being made, b) to providing feedback to AM tool for correction, or to stop the process if the part will not meet the quality, thus saving time, energy and reduce material loss. The approach is based on multi-parameter imaging technique that can detect flaws in real-time for each AM print layer, such as dimensional deviation, micro-structured defects, wide gap between print lines, and determine surface finish, to name a few. Using multi-parameter approach provides measurement redundancy, maximizing likelihood of detecting defects that may otherwise be missed using a single parameter sensing approach, and avoids false readings.

During this research study, AM parts will be tested with the proposed approach both on a bench-top as well as while being printed in an AM tool. The predicted results will be compared to actual flaws. Current and future unit size requirements, component specifications, speed, accuracy, output parameter and specifications will be determined, and adaptability to current and future ISM systems will be established.

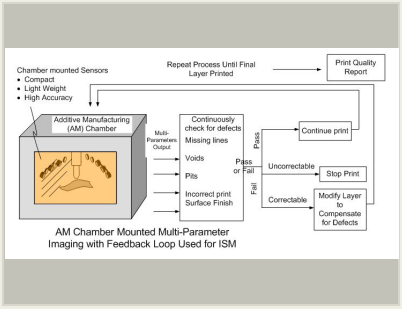
Observed defect parameters will be correlated to known values, thus enabling prediction of part performance/material outcomes, and the approach will be demonstrated into a ground based AM systems.

Successful completion of the Phase I feasibility study will meet the subtopic requirements by demonstrating the in-situ quality control approach for in-ground AM systems, which has high extensibility to ISM, and results in correlating and predictive material outcomes.

Anticipated Benefits

For NASA applications, the proposed innovation will be used for quality control for in-space manufacturing (ISM). An example application is for using in platforms aboard international space station.

For non-NASA commercial applications, this technique can be an add-on quality control and feedback to additive manufacturing units. The economic benefits include reduction of cost of post process testing, and significant reduction of loss of labor and material due to faulty parts.



AM Chamber Mounted Multi-Parameter Imaging with Feedback Loop Used for ISM

In-Situ Monitoring of In-Space Manufacturing by Multi-Parameter Imaging, Phase I

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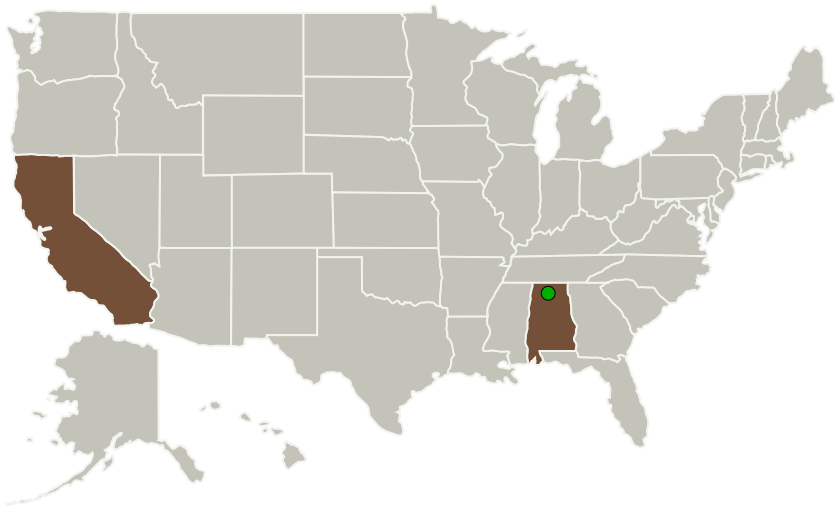
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ler Technologies, Inc.	Lead Organization	Industry	Encinitas, California
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	California

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141829)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ler Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

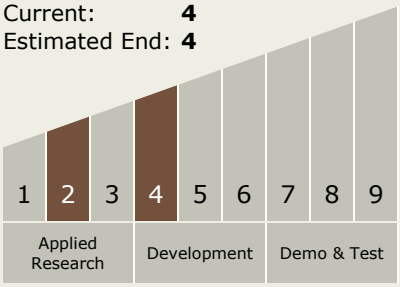
Carlos Torrez

Principal Investigator:

Araz Yacoubian

Technology Maturity (TRL)

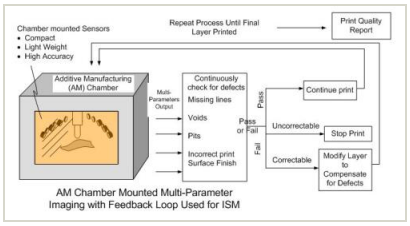
Start: **2**
Current: **4**
Estimated End: **4**



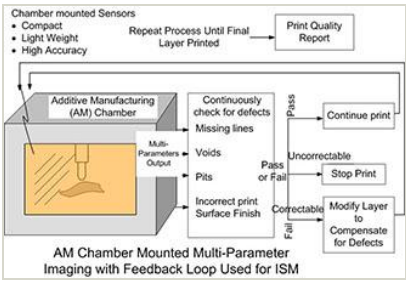
In-Situ Monitoring of In-Space Manufacturing by Multi-Parameter Imaging, Phase I

Completed Technology Project (2018 - 2019)

Images



Briefing Chart Image
In-Situ Monitoring of In-Space Manufacturing by Multi-Parameter Imaging, Phase I *(https://techport.nasa.gov/image/132395)*



Final Summary Chart Image
In-Situ Monitoring of In-Space Manufacturing by Multi-Parameter Imaging, Phase I *(https://techport.nasa.gov/image/128313)*

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destination

Earth